CHAPTER 1

INTRODUCTION

1.1 Background of study

Since the beginning of the "Green Revolution" in the early 1970's, which focused on food crop productivity, through high-yielding varieties, agrochemicals and irrigation system, chemical fertilizers were extensively used throughout most of agricultural Asia. In fact, Asia is the world's largest user of chemical fertilizers, consuming around 40% of the global total each year. The emphasis on chemical fertilizers, which sometimes led to injudicious application, has meant that the soil be regarded as an inert substrate for plant roots, instead of a living biosphere, the rhizosphere, containing a myriad of organisms. It is now realized that in agricultural lands under intensive monoculture system, including paddy rice, which receive heavy applications of chemical fertilizers alone, productivity is slowly declining, and environmental quality is deteriorating too. In the light of these problems, the use of organic fertilizers, biofertilizers and other microbial products is crucial in the current attempt to make the agriculture industry a viable component of a healthy and pleasant ecosystem (www.fnca.mext.go.jp).

A healthy plant usually has a healthy rhizosphere which should be dominated by beneficial microbes (Chen, 2008). Rhizosphere of the plant is clearly depicted in Figure 1.1. Conversely in unhealthy soil, it is dominated by pathogenic microbes that can obstruct optimum plant growth.

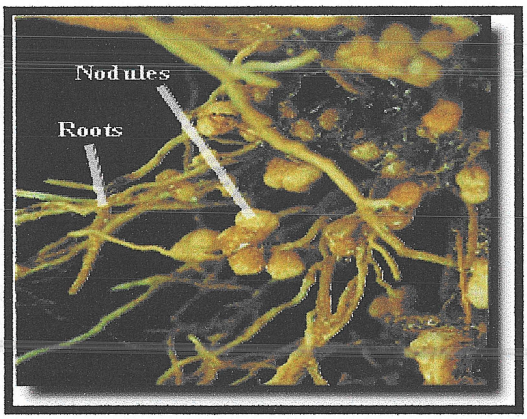

Figure 1.1: Rhizosphere of plant (www.wikipedia.com)

There are plentiful of microorganisms thriving in soil (Wu *et al.*, 2003). It is well known that a considerable number of bacterial and fungal species possess a functional relationship and constitute a holistic system with plants. They are able to exert beneficial effects on plant growth (Vessey, 2003; Wu *et al.*, 2003). Application of beneficial microbes in agricultural practices started 60 years ago and now there is increasing evidence that these beneficial microbial populations can also enhance plant resistance to adverse environmental stresses such as water and nutrient deficiency and heavy metal contamination (Shen, 1997; Wu *et al.*, 2003). Moreover, the implementation of beneficial microbes to the crop is the best answer to void the excess application of chemical fertilizer to crop land that can causes ecological problems such as pollution. Therefore, biofertilizer has been identified as an alternative source rather than using chemical fertilizer to raise soil fertility and yield production in sustainable farming.

Nowadays, biofertilizers are considered the most advanced biotechnology that can increase the production, improve the quality and developing an organic, green and non-poluted agriculture. In addition, biofertilizers contain a variety of beneficial microorganisms and enzymes which accelerate and improve plant growth and protect plants from pests and diseases. Completely fermented organic matters resulted in biofertilizers which improve the physical properties of soils, enrich air aeration, water and nutrient retention capacity. Biofertilizers provide the cultivated plants with the macro as well as micronutrients, required for healthy growth, therefore, improve yield and quality of agricultural crops, and reduce the overall cost of chemical fertilizers as pesticide application.

1.2 Problem Statement

Biofertilizers are products containing living cells of different types of microorganisms, which have an ability to convert nutritionally important elements from unavailable to available form through biological processes (Hegde *et al.*, 1999; Vessey, 2003; Wu *et al.*, 2003) In recent years, biofertilizers have emerged as an important component of the integrated nutrient supply system and hold a great promise to improve crop yields through environmentally better nutrient supplies (Wu *et al.*, 2003). However, farmers are prefer to use chemical fertilizer rather than biofertilizer because of the efficiency of biofertilizer is depends on the components available in raw materials as well as contribution from living microorganisms in them (Hasarin and Viyada, 2008). Moreover, their performance also depends on whether the environments they are introduced to are conducive. Therefore, the application of biofertilizer in practice, somehow, has not achieved constant effects. The mechanisms and interactions among these microbes still are not well understood, especially in real applications.